Date: Mon, 27 Jun 94 04:30:19 PDT
From: Ham-Ant Mailing List and Newsgroup <ham-ant@ucsd.edu>
Errors-To: Ham-Ant-Errors@UCSD.Edu
Reply-To: Ham-Ant@UCSD.Edu
Precedence: Bulk
Subject: Ham-Ant Digest V94 #201
To: Ham-Ant

Ham-Ant Digest Mon, 27 Jun 94 Volume 94 : Issue 201

Today's Topics:

Send Replies or notes for publication to: <Ham-Ant@UCSD.Edu>
Send subscription requests to: <Ham-Ant-REQUEST@UCSD.Edu>
Problems you can't solve otherwise to brian@ucsd.edu.

Archives of past issues of the Ham-Ant Digest are available
(by FTP only) from UCSD.Edu in directory "mailarchives/ham-ant".

Date: 26 Jun 1994 13:37:05 -0400
From: newstf01.cr1.aol.com!search01.news.aol.com!not-for-mail@uunet.uu.net
Subject: 4 square phased array
To: ham-ant@ucsd.edu

I would like to set up a "4 square" 40 MHz phased array of 4 folded
dipoles each 1/2 wavelength from the other and 1/4 wavelength above
ground. This should give me a broadside 50 x 50 deg beam pointing
straight up. But i need the beam to be pointing 40 deg from the
horzion in elevation. I intend to use 300 ohm TV lead.

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                        /                  /
                       /                  /            I am using
Kraus' book
                 ant. 1          ant. 2           "Antennas", and the
ARRL
                                                       Antenna
Handbook.  I have
                                                       very little
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experience in this
                   /                   /                area. I have
the following
                  /                  /                  questions.
             ant. 3             ant. 4
```

1) Do I phase the group of 4 by phasing ant. 1 & ant. 2, then similarly phase ant. 3 & ant. 4?

2) If the earth acts as a reflector or ground plane, is it physically connected to the dipoles?

3) How do I attach the leads from the antannas? Can I parallel them and use baluns to match the receiver line?

I'll apreciate any comment.

Thanks
Ray

Date: Sun, 26 Jun 1994 13:29:55 GMT
From: ihnp4.ucsd.edu!swrinde!gatech!kd4nc!ke4zv!gary@network.ucsd.edu
Subject: Dipole impedance?
To: ham-ant@ucsd.edu

In article <2ue991$48@hippo.shef.ac.uk> ph922806@silver.shef.ac.uk (A Armitage) writes:
>I've built several home designed, low power (approx 0.5Watts) short wave
>radio transmitters. At the moment I'm operating from a home made dipole
>aerial mounted horizontaly with a full span of about 20 meters. To feed
>the dipole I'm using 50 Ohm co-axial cable (not the best thing) but what
>I'd really like to know is how do I adjust the dipole length to match the
>impedances correctely. If anyone knows or has any equations relating
>dipole length to impedance I'd be greatfull. Thanks

It's not quite that simple. A dipole has it's lowest impedance when cut to resonance. The reactive part of the impedance rises either side of resonance. The resistive part of the impedance varies in a more complex way, with radiation resistance at a particular frequency generally decreasing as gross physical length is reduced. Loss resistance, which appears as part of the terminal impedance, varies with several factors including conductor diameter and the conductance of the material. Loss resistance also is proportional to the proximity of partially conductive objects, including the Earth.

In any event, you want maximum radiation from the antenna, and that's

roughly proportional to the amount of current you can push through the radiation resistance of the antenna, so you need to minimize the reactive component of the antenna's terminal impedance. And to minimize the amount of power wasted as heat you need to minimize loss resistance. You minimize reactance by cutting the antenna to resonant length for the frequency in use. Whatever impedance is left is radiation resistance (and loss resistance), and that's what you've got to match to the transmitter, whatever value it may have for a particular antenna. That's why you use matching networks. These are ideally impedance transformers composed of pure reactances that consume no power themselves. Typical networks are of the L or Pi configuration, though conventional RF transformers work well for balanced feeds. Any good antenna book will have the equations for designing proper matching networks.

Loss resistance needs to be minimized, but in the real world it can never be completely eliminated. The best we can do is try to maintain the highest ratio possible of radiation resistance to loss resistance. That's because power is proportional to I^2*R, we want current high for maximum radiation, and we want losses low for highest efficiency. There are two avenues to attacking that problem. First we can try to make the radiation resistance as high as possible. That generally means making the antenna bigger (up to natural resonant length, physically small electrically loaded antennas will have a lower radiation resistance). Second, we can attempt to minimize loss resistances. Conductor resistance is part of that, so we should use as large a diameter, and as high a conductivity material, as possible for the antenna element. And we should locate the antenna as far as possible from lossy partially conducting objects, most notably the Earth. (For verticals that must work against a groundplane, we should attempt to improve the conductivity of the groundplane as much as possible.)

A horizontal 20 meter dipole has a free space radiation resistance of about 70-75 ohms at resonance. A horizontal dipole mounted low over the Earth will have a lower impedance due to mutual coupling with the Earth. At a half wavelength height, it'll have a terminal impedance of about 50 ohms, and part of that will be series loss resistance due to the imperfect conductivity of the antenna and the Earth. At lower heights, things become complex as the Earth coupling increases and near field effects dominate.

Just pruning antenna length for lowest VSWR reading *should* put the antenna at resonance in most instances, but typically it will *not* achieve a perfect 1:1 match. IE the ideal terminal impedance, consisting only of radiation resistance (and series loss resistance), may not occur at the characteristic impedance of the feedline.

A common example of this sort of thing is a mobile whip antenna. Ideally, if it's a full physical 1/4-wave over an ideal groundplane, it'll have a 37.5 ohm terminal impedance. That won't give a 1:1 SWR with 50 ohm cable.

Adjusting antenna length in an attempt to get a 1:1 reading will require taking the antenna off resonance, and will add a reactive component that makes the antenna harder to drive efficiently. The better approach is to use a matching network to transform the 50 ohm characteristic impedance of the cable to the 37.5 ohm impedance of the resonant length antenna.

(Making the antenna reactive by pruning it off resonance just limits the amount of current that can flow through the radiation resistance of the antenna since the reactance is in series with the radiation resistance. Ideally this doesn't matter since reactances are lossless and the transmitter output impedance can be raised to continue to drive the same current through the radiation resistance as in the resonant case. In the real world, that's often impractical, and the higher terminal voltage required can lead to arc overs and corona losses.)

In the real world, especially with physically shortened antennas, the radiation resistance may be much lower, on the order of 2 to 5 ohms. And the loss resistance may be quite high, on the order of 30-40 ohms. So when you get 1:1 SWR, you almost certainly aren't getting maximum performance from the antenna. Most of your power is being consumed in the loss resistance rather than in the desired radiation resistance.

Loss resistance has another effect. With high loss resistance the antenna Q will be low and the SWR bandwidth will be broad. This is another sure indication that your antenna isn't efficient. An efficient antenna should have a relatively narrow SWR bandwidth. (For the purposes of this discussion, we'll define SWR bandwidth as the bandwidth between the 2:1 SWR points.) This is of particular interest to users of HF mobile antennas. A typical 8 foot coil loaded stick that has a SWR bandwidth of more than 20 kHz on 75 meters is almost certainly very inefficient.

Gary
--

```
Gary Coffman KE4ZV          |    You make it,     | gatech!wa4mei!ke4zv!gary
Destructive Testing Systems |    we break it.     | uunet!rsiatl!ke4zv!gary
534 Shannon Way             |    Guaranteed!      | emory!kd4nc!ke4zv!gary
Lawrenceville, GA 30244     |                     |
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Date: Sun, 26 Jun 1994 13:37:14 GMT
From: ihnp4.ucsd.edu!swrinde!gatech!kd4nc!ke4zv!gary@network.ucsd.edu
Subject: Quadfiliar helix for GPS
To: ham-ant@ucsd.edu

In article <Crwqps.88r@twisto.eng.hou.compaq.com> susan@pokey.eng.hou.compaq.com (Susan Scott) writes:
>Just got onto this forum, so please excuse if this is a repeat question.

>Has anybody tried to build an external antenna for a GPS? In one of these
>radio posts, someone mentioned that the quadrafiliar helix antenna was
>what I needed and that the description could be found in old ARRL Antenna
>Handbooks. Well, I got the book, but the information is too general for
>a novice like me to translate into an actual antenna. Has anyone tried it?
>Any suggestions? ALthough I paid a lot for the GPS, I hate to have to spend
>the extra couple of hundred they want jst for 20' of coax and this antenna!
>Thanks.

Most GPS remote antennas are more than just an antenna. They almost always include at least a preamp, and in some cases a complete down converter assembly. That's because the small flexible coaxes used have too great a loss at GPS frequencies to be overcome by just antenna gain alone. That's why the antennas are expensive, they actually duplicate circuitry in the receiver remotely at the antenna. Constructing such circuitry at home is a rather advanced amateur technique. Unless you're experienced at microwave construction, it's probably best to pay the money for the factory remote antenna.

Gary
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```
Gary Coffman KE4ZV           |    You make it,     | gatech!wa4mei!ke4zv!gary
Destructive Testing Systems  |    we break it.     | uunet!rsiatl!ke4zv!gary
534 Shannon Way              |    Guaranteed!      | emory!kd4nc!ke4zv!gary
Lawrenceville, GA 30244      |                     |
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Date: 27 Jun 1994 01:08:57 GMT
From: ihnp4.ucsd.edu!swrinde!howland.reston.ans.net!spool.mu.edu!bloom-beacon.mit.edu!senator-bedfellow.mit.edu!news.mit.edu!monta@network.ucsd.edu
Subject: Quadfiliar helix for GPS
To: ham-ant@ucsd.edu

susan@pokey.eng.hou.compaq.com (Susan Scott) writes:

> Just got onto this forum, so please excuse if this is a repeat question.
> Has anybody tried to build an external antenna for a GPS? In one of these
> radio posts, someone mentioned that the quadrafiliar helix antenna was
> what I needed and that the description could be found in old ARRL Antenna
> Handbooks. Well, I got the book, but the information is too general for
> a novice like me to translate into an actual antenna. Has anyone tried it?
> Any suggestions? ALthough I paid a lot for the GPS, I hate to have to spend
> the extra couple of hundred they want jst for 20' of coax and this antenna!
> Thanks.

There's a nice description of a homebrew GPS system in the proceedings of ARRL's 9th Computer Networking Conference. It's

a data only system, but I've learned much from examining the design.

The author describes a quadrifilar made with semirigid coax, along with a preamp, downconverter, and receiver. More recent preamp designs will have lower noise; you'll have to balance this with antenna noise temperature, since the quadrifilar will see a good deal of warm earth and therefore won't be terribly low-noise itself.

I have seen descriptions of crossed-dipole GPS antennas with a coaxial scalar horn to control illumination. If you're dealing with a fixed installation that needs high performance, this might be the way to go, though they would be more difficult to reproduce. For current information on GPS receiver hardware, you might check out the magazine _GPS World_.

Peter Monta   monta@image.mit.edu
MIT Advanced Television Research Program

Date: Mon, 27 Jun 1994 04:42:04 GMT
From: ihnp4.ucsd.edu!usc!howland.reston.ans.net!europa.eng.gtefsd.com!newsxfer.itd.umich.edu!zip.eecs.umich.edu!umn.edu!kksys.com!edgar!tdkt!rohrwerk@network.ucsd.edu
Subject: simple SSB receiving
To: ham-ant@ucsd.edu

In article <2shr81$br8@mail.fwi.uva.nl> agterkam@fwi.uva.nl (Dirk-Jan Agterkamp (I89)) writes:
>Currently I'm
>planning to build a receiver, who doesn't. However, my intension is NOT
>to use Xtal filters and NOT
>to use a large number of OPAMPS to create sharp lowpass
>filters. My plan is to use a phasing method instead.

>Thanks in advance, Dirk. e-mail: agterkam@fwi.uva.nl

You should check out January 1993 QST, "High-Performance Single-Signal Direct Conversion Receivers." It is a very elegant implementation of the "phasing" approach for a receiver. In March, he details a companion phasing SSB exciter.

Bye for now,
John K0JD

 -> Alice4Mac 2.3 E QWK Eval:05Mar94

Date: Mon, 27 Jun 1994 02:22:23 GMT
From: ihnp4.ucsd.edu!library.ucla.edu!csulb.edu!csus.edu!netcom.com!
wa2ise@network.ucsd.edu
Subject: Thick Ethernet cable in place of RG cables ???
To: ham-ant@ucsd.edu

I've used thick Ethernet cable for a 2 meter antenna feed, and it worked
fine. Looked up the specs in a Beldon catalog, it's similar to RG8U,
50 ohm coax. Talked with someone at Beldon and he said they tested
it to several gigahertz, and it acts like any other coax, i.e, nothing
wierd happens in the VHF and UHF range.

Date: 25 Jun 1994 23:04:58 +0300
From: ihnp4.ucsd.edu!usc!howland.reston.ans.net!EU.net!chsun!imp.ch!news.funet.fi!
news.cs.tut.fi!news.cc.tut.fi!proffa.cc.tut.fi!not-for-mail@network.ucsd.edu
To: ham-ant@ucsd.edu

References <2uh1bh$lb4@news.u.washington.edu>, <S>,
<jtara.485.2E0C5B34@cts.com>hsu
Subject : Re: A Question on Yagi's.

Jon Tara (jtara@cts.com) wrote:

> In article <2uh1bh$lb4@news.u.washington.edu>
> popllama@u.washington.edu (Alec Muzzy) writes:

> >Ok, so I have come to the conclusion that a Yagi is the more or less best
> >design for a specific frequency when pulling in a distant station. So here's
> >my question on a Yagi. I need one tuned for 89.9FM. What would the lengths

> Go to a store that sells ham radio equipment and pick up a book on VHF
> antennas. (I beleive that the ARRL publishes such a book - I have one
> somewhere.)

Look for an antenna for 144 MHz and scale all dimensions (including tube
diameter) to 89.9 MHz by multiplying each dimension by 144/89.9 (= 1.6).
If the original antenna was designed for the middle of the 2 m band
(146 MHz), multiply by 146/89.9 (= 1.62).

> There is no "optimum" number - each reflector
> successivly narrows the beam width, increasing the gain. 22 elements is a

> popular "large" number of elements, but you can have more.

22 elements require a boom length of 7 wavelengths or about 21 m and it
has a gain of about 18 dB.

>You're probably better off just buying a commerical FM antenna, which will be
>typically cut for the center of the band. A better one will have adjustable
>elements, which you can tune to the specific frequency, though for reception
>it won't make a heck of a lot of difference over the bandwidth of the FM band.

The FM broadcast band is 20 MHz wide or a relative bandwidth of 20 % !!
If the antenna is designed for that bandwidth, it will not have as much
gain as an antenna which is cut for a specific frequency.

> There are many other antenna designs that would be suitable, however. For
> example, since FM signals are polarized in both directions (horizontal and
> vertical) a circularly-polarized antenna may give you better performance,
> since it will pick up BOTH components of the wave.

Are the FM transmitters really circularly polarized ? I have only heard
of circular polarized TV-transmitter tests in urban areas to reduce ghosts.
Assuming that a specific FM-transmitter is either horisontally or
vertically polarized, find out what your transmitter is using and
orientate your antenna acordingly. There is no point of using circular
polarisation if you want to receive a single station.

You can get circular polarisation with crossed yagies and the polarisation
can be reversed (right hand or left hand circular polarized) by a relay.

> Oh, a couple more comments on circularly-polarized antennas.
> There are various types of these, but the one I am thinking looks
> a lot like a Yagi, but consists of loops rather than poles.

It is called a loop yagi and it is not circularily polarized.

> It somewhat like a "quad" antenna, which is composed of square loops,
> (and I beleive is also circularly polarized).

It is not circularily polarized. If it is fed at the bottom of the loop
or quad, it is horisontally polarized and if fed from the side it is
vertically polarized.

> There also are some bizarre antennas that consist of a single spiral, but
> again (like the coat-hanger technique) most easily done at higher frequencies
> than this.

It is a helical antenna and it is truly circularly polarized.
There are separate antennas for right hand and right hand circular

polarisation. The diameter of the spiral is about 1 m for the FM broadcast band.

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End of Ham-Ant Digest V94 #201
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